FINAL REPORT

Assessment of Geology, Energy, and Minerals (GEM) Resources

POLE CREEK GEM RESOURCE AREA

(ID-010-10)

OWYHEE COUNTY, IDAHO

Prepared for

United States Department of the Interior
United States Bureau of Land Management
Scientific Systems Development Branch

March 1983

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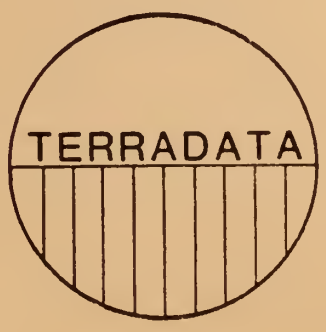

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Assessment of Geology, Energy, and Minerals (GEM) Resources

Pole Creek GRA (ID - 010 - 10) Owyhee County, Idaho

Prepared For:

United States Department of the Interior
United States Bureau of Land Management
Scientific Systems Development Branch

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This report was prepared as part of a Phase I Assessment of GEM Resources within designated Wilderness Study Areas in Oregon, Idaho and Nevada.

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DISCLAIMER

This document is part of a report prepared under Contract Number YA - 553 - CT2 - 1042 for the United States Department of the Interior, Bureau of Land Management. Although officials of the Bureau of Land Management have provided guidance and assistance in all stages of the project, the contents and conclusions contained herein do not necessarily represent the opinions or policies of the Bureau.

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- Dr. Antonius Budding - Oil Shale and Tar Sands
- Mr. Raymond Corcoran - Field Verification
- Dr. James Firby - Paleontology
- Mr. Ralph Mason - Coal
- Mr. Richard Miller - Uranium and Thorium
- Mr. Vernon Newton - Oil and Gas
- Mr. Herbert Schlicker - Industrial Minerals and Geologic Hazards
- Dr. Walter Youngquist - Geothermal
- Dr. Paul Weis - Metals and Non - Metals.

Mr. Edwin Montgomery provided valuable insight and assistance in structuring the project and these reports in order to best serve the purposes of the Bureau of Land Management. We greatly apppreciate his assistance.

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Mr. Tom Mitchell assisted in the stream sediment sampling program. Bondar - Clegg provided the geochemical analysis of stream sediment samples.

Ms. Pamela Ruhl provided clerical and editorial assistance throughout the project. Ms. Sara Mathews assisted with occurrence information and drafting. Mr. Philip R. Jones and Mr. Michael A. Becker produced all documents relating to the project using TERRADATA's word processing and document production systems.

EXECUTIVE SUMMARY

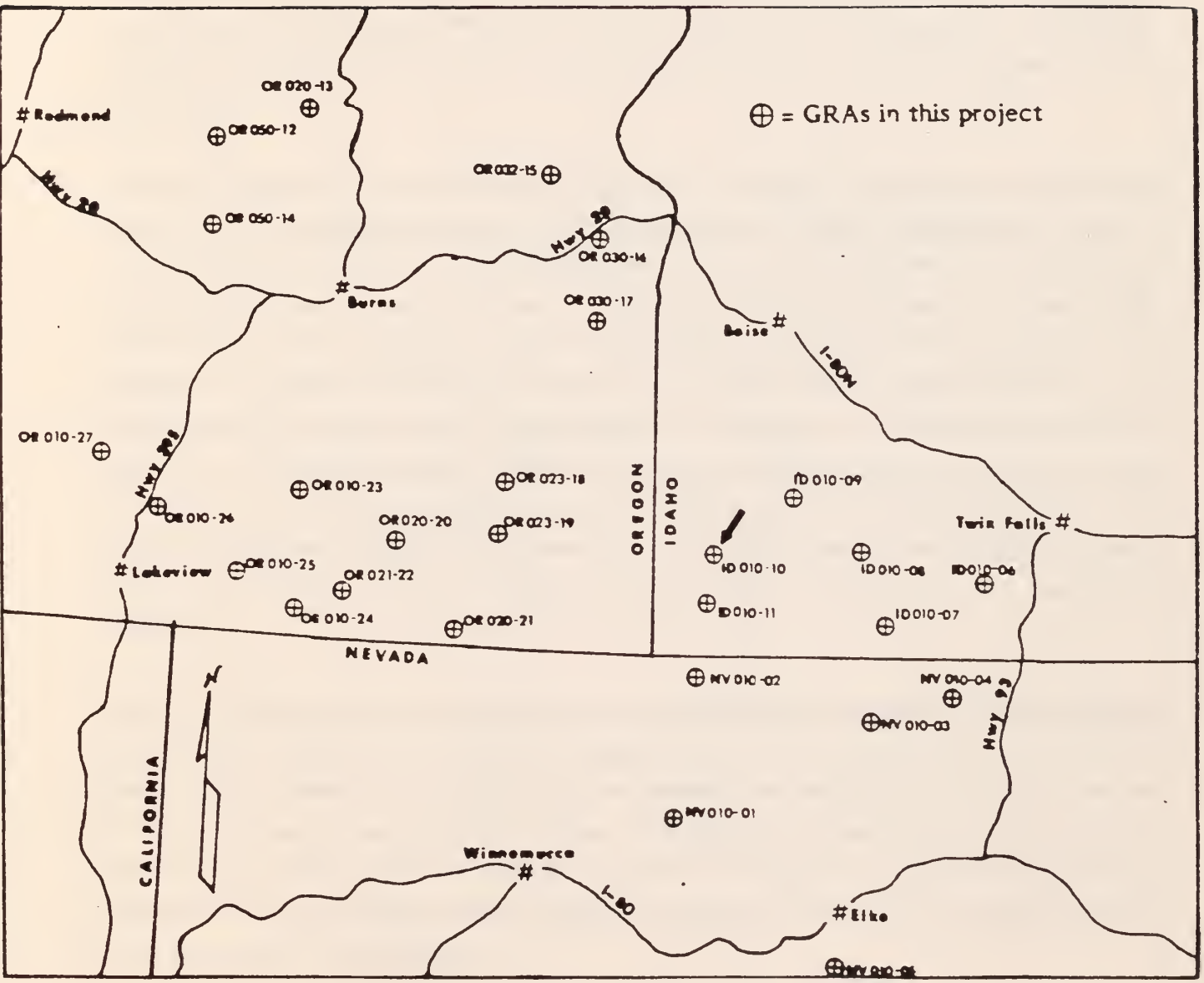
The purpose of this project is to evaluate and classify environments favorable for the occurrence of geology, energy, and minerals (GEM) resources in selected wilderness study areas (WSAs) in southeastern Oregon, southwestern Idaho, and northern Nevada. **(See TERRADATA report entitled "Procedures for the Assessment of Geology, Energy, and Minerals (GEM) Resources.")** GEM resource environments have been rated on a scale that ranges from one to four, with one being least favorable and four being most favorable. Favorability classes two and three represent low and moderate favorability, respectively. Confidence levels range from A to D with A being low confidence and D being high confidence. The confidence levels are directly related to the quantity and quality of the information available for the determination of the favorability classes.

The specific area with which this report deals is the Pole Creek GRA (GRA number ID-010-10) which is located in southwestern Idaho near the Oregon-Idaho State line (see attached location map). The GRA contains about 180 square miles within Townships 10S and 11S and Ranges 1W through 3W. It contains two WSAs that have a combined area of 36,019 acres. These are WSA 16-44 (11,510 acres) and WSA 111-18 (24,509 acres). The study area is in the Owyhee and Bruneau Resource Areas of the Boise BLM District.

The GRA is within the Owyhee Upland sub-province of the Columbia Intermontane physiographic province. Rocks exposed in the GRA are all Tertiary or younger volcanic flows, domes, and related volcaniclastic sedimentary strata. Limited exposures of Miocene lacustrine units also occur within the GRA. A caldera that is 20 to 25 miles in diameter is a major structural element located six miles north of the GRA. The area is located on or near the axis of the Devonian Antler orogenic belt. Basin and Range block faulting is not apparent in the area because of the thick mantle of Tertiary and Quaternary volcanics. The Pole Creek GRA is not near any known mineral belts or mining districts. Historically, the area has had no significant production of any GEM resources.

The geologic environments and inferred geologic processes indicate low favorability for the accumulation of most GEM resources. The nature of the data available and the geometry of potential geologic environments do not permit subdivision of the GRA into commodity specific areas of favorability.

GRA Location Map

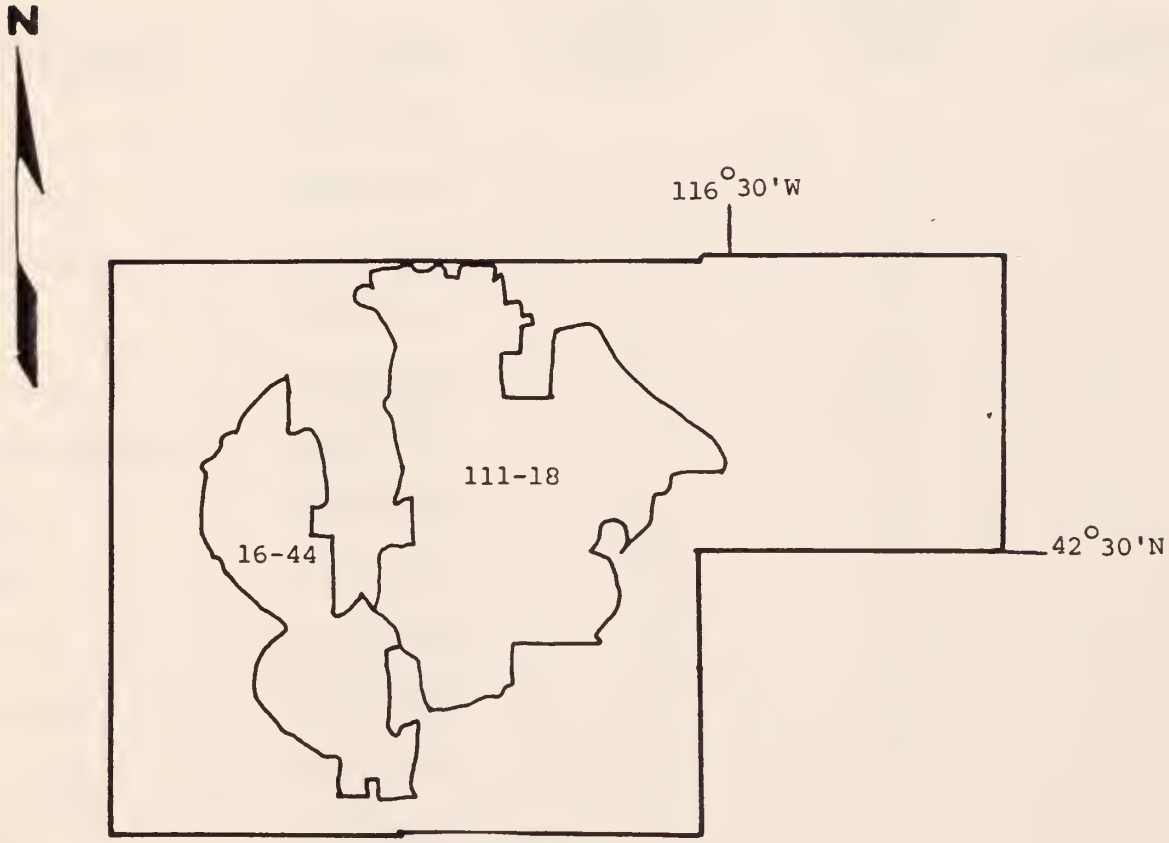


The Pole Creek GRA contains one geologic environment that is highly favorable for the occurrence of diatomite resources. The entire GRA is classified 4D for potential diatomite resources in accordance with the BLM classification scheme (see attached land classification map); the geologic environment, the inferred geologic processes, and known occurrences indicate high favorabiity for the occurrence of this resource. Diatomite occurrences exist in the the GRA. Therefore, the confidence level (D) is assigned to this evaluation.

The entire area has low favorability (Class 2) for metals, clinoptilolite, and bentonite resources. The confidence levels of the classifications for these commodities are low (A or B) denoting insufficient available data and a lack of reported mineral occurrences. The area is least favorable (Class 1) for all remaining GEM resources (see GEM Classification and Confidence Level Table below). Evaluation of environments for geothermal, uranium and thorium, oil and gas, oil shale and tar sands, limestone, and paleontological resources have varying degrees of confidence. In general, environments essential for the accumulation of these resources do not exist within the study area. The oil shale and tar sands evaluation is based on minimal direct evidence (Level C). All other least favorable classifications have low confidence levels (A or B), signifying that insufficient or only minimal indirect evidence was available for the respective evaluations.

Further surface geologic investigations, including detailed mapping and stratigraphic studies, could enhance the confidence levels of many of the classifications in the Pole Creek GRA. Sub-surface investigations are probably not warranted in this area due to the costly nature of the available methods. Geophysical and geochemical surveys might provide some insight into the potential resources in the study area. Detailed geophysical examination of the inferred caldera might be important, as similar structures are known to be mineralized in other areas.

Land Classification Map
Pole Creek GRA
(ID - 010 - 10)
Owyhee County, Idaho



Scale 1:250,000
(Jordan Valley 1°x2° NTMS Quadrangle)

Entire GRA classified, no subareas.

Classification Of Lands Within The Pole Creek GRA (ID - 010 - 10) Owyhee County, Idaho For GEM Resource Potential

COMMODITY	AREA	CLASSIFICATION LEVEL	CONFIDENCE LEVEL	REMARKS
Metals	Entire GRA	1	B	
Geothermal	Entire GRA	1	B	
Uranium/Thorium	Entire GRA	1	A	
Coal	Entire GRA	2	B	
Oil and Gas	Entire GRA	1	B	
Tar Sands/Oil Shale	Entire GRA	1	C	
Limestone	Entire GRA	1	A	
Bentonite	Entire GRA	2	A	
Diatomite	Entire GRA	4	D	
Clinoptilolite	Entire GRA	2	A	
Paleontology	Entire GRA	1	A	
Hazards	See Hazards Map (GRA File)			
ESLs	None	1	C	

LEGEND:
Class 1 - Least Favorable
Class 2 - Low Favorability
Class 3 - Moderate Favorability
Class 4 - High Favorability

Confidence Level A - Insufficient data or no direct evidence
Confidence Level B - Indirect evidence available
Confidence Level C - Direct evidence but quantitatively minimal
Confidence Level D - Abundant direct and indirect evidence

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1. INTRODUCTION

This report is one of 27 GRA technical reports that summarize the results of a Phase 1 assessment of the geology, energy, and minerals (GEM) resources in selected portions of southeastern Oregon, southwestern Idaho, and northern Nevada. The study region was subdivided into 27 GEM resource areas (GRAs), principally for ease of data management and interpretation. The assessment of GEM resources for this project consisted of an interpretation of existing literature and information by experts knowledgeable in both the geographic area and specific commodities. It is possible that the assessment would be different if detailed field exploration, geochemical sampling, and exploratory drilling programs were undertaken. (See the TERRADATA report entitled "Procedures for the Assessment of Geology, Energy, and Minerals (GEM) Resources.")

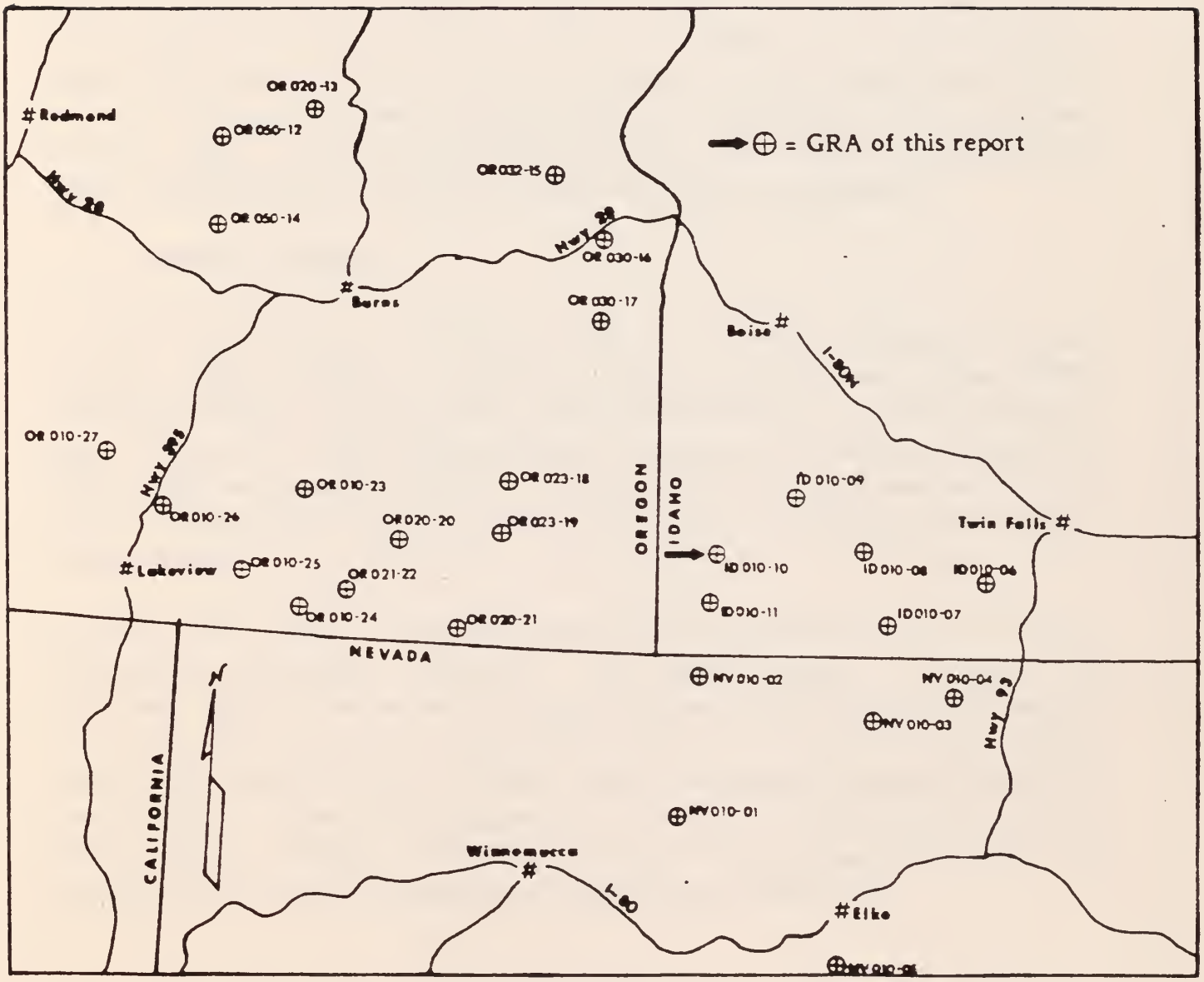
This report summarizes the assessment of the GEM resources potential of the Pole Creek GRA (ID-010-10). See Figure 1-1. Commodity categories for which this GRA was evaluated are:

- Metals
- Oil and Gas
- Oil Shale and Tar Sands
- Geothermal
- Uranium and Thorium
- Coal
- Industrial Minerals
- Paleontological Resources
- Geologic Hazards
- Educational and Scientific Localities (ESLs)

Geologic environments within the Pole Creek GRA have been rated with respect to their favorability for the occurrence of these different commodities. The favorability rating scale ranges from one to four, with one being least favorable and four being most favorable. Confidence levels in these ratings also have been assigned. These confidence levels range from A to D, with A being low confidence and D high confidence. Assigned confidence levels are related to the quantity and quality of the information available for the determination of the favorability ratings.

FIGURE 1-1

GRA Location Map



2. DESCRIPTION OF THE POLE CREEK GRA

2.1 LOCATION

The Pole Creek GRA (ID-010-10) is in southwest Idaho. It lies between latitudes 42°25'N and 42°35'N and longitudes 116°25'W and 116°45'W. The GRA contains approximately 180 square miles within townships 10S and 11S and ranges 1W and 3W (see Figures 1-1 and 2-1). The area contains two Wilderness Study Areas; WSA 16-44 (11,510 acres) and WSA 111-18 (24,509 acres). The Pole Creek GRA is in the Owyhee and Bruneau Resources Areas of the Boise BLM District. The area is about 75 miles from Boise, Idaho, which is the nearest transportation center offering a minimum of rail, highway, and/or charter-air services. Access to the contained WSAs is via county maintained dirt or packed-gravel roads. Vehicular access to the interior of the WSAs is poor to non-existent.

2.2 GENERAL GEOLOGY

The Pole Creek GRA is in the Jordan Valley 1°x2° NTMS quadrangle map in the southwest corner of Idaho. The data available for this area includes NURE investigations[1,2,3,4]*, general mineral resource information[5], and limited large scale geologic mapping[6]. Reconnaissance geologic mapping (scale 1:62,000), magnetic and gravity maps, and geochemical data are available for the northern three-fourths of the GRA[7]. Resource and geologic information for the Pole Creek GRA are good, compared with other GRAs.

The Pole Creek GRA is within the Owyhee Upland sub-province of the Columbia Intermontane physiographic province[8]. The Owyhee Upland is a plateau and mountainous region in northern-most Nevada, southwest Idaho, and southeast Oregon. The Owyhee Upland sub-province is separated from the Great Basin by a major drainage divide located south of the GRA in Nevada. The area is bounded on the north by the High Lava Plains (Snake River Plain) sub-province of the Columbia Intermontane province. Tertiary rhyolites, andesites, and basalts are the oldest rocks exposed in the GRA. The youngest rocks are Quaternary basalts and tuffaceous units (Figure 2-2).

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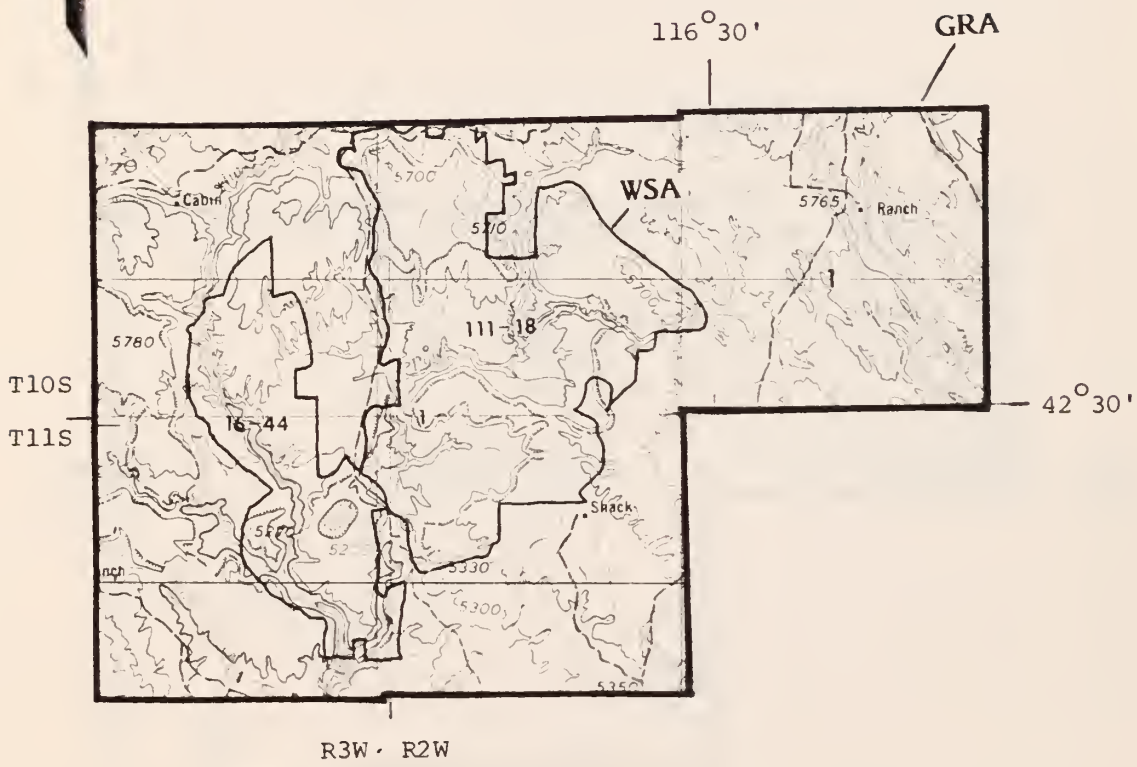
* In this report, citations are superscripted numbers. They refer to bibliogragphic entries listed in Appendix A: References Cited.

FIGURE 2-1

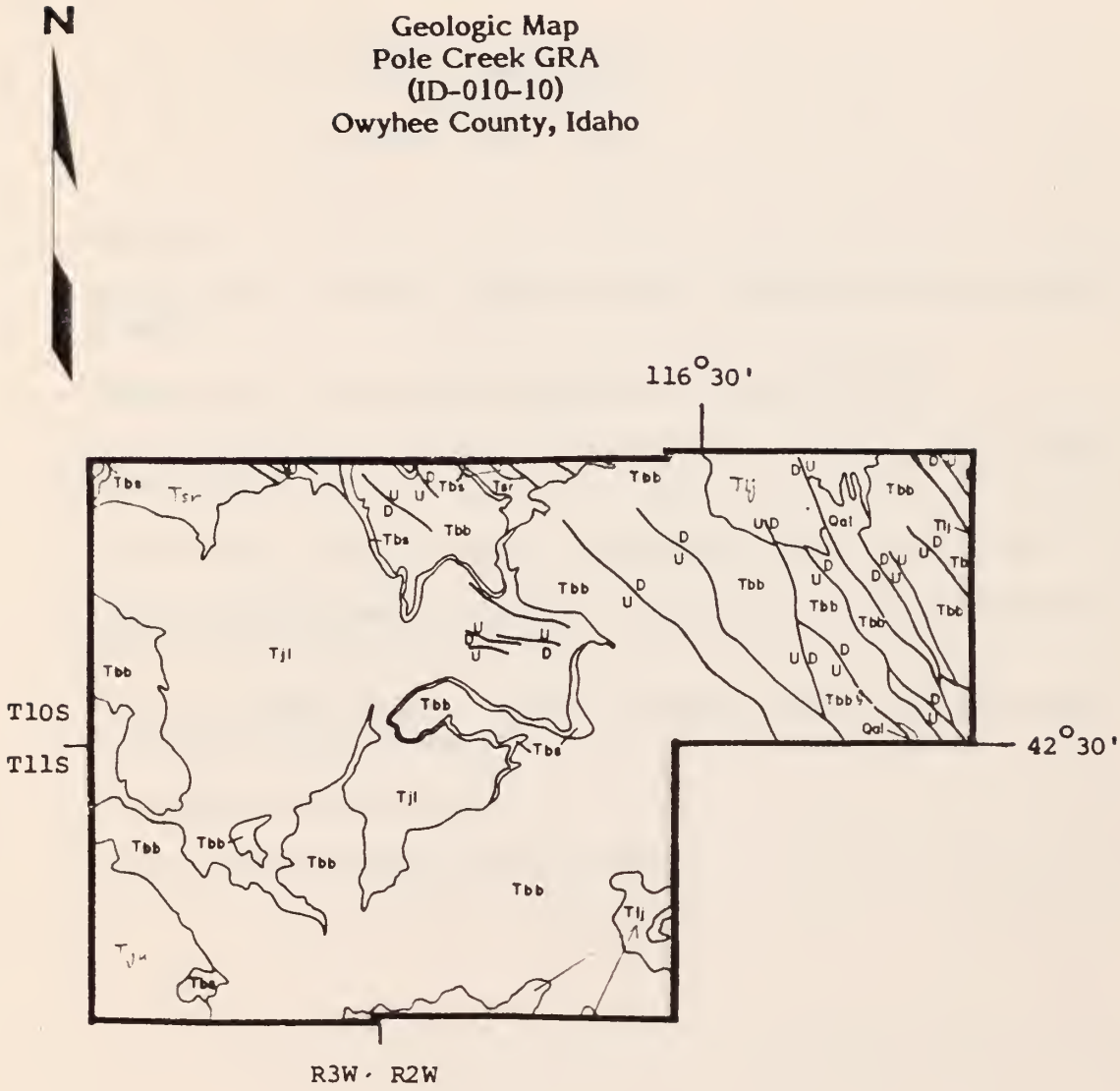
Topographic Map
Pole Creek GRA
(ID-010-10)
Owyhee County, ID



Scale 1:250,000
(Jordan Valley 1°x2° NTMS Quadrangle)

FIGURE 2-2

Geologic Map
Pole Creek GRA
(ID-010-10)
Owyhee County, Idaho



Scale 1:250,000
(Jordan Valley 1°x2° NTMS Quadrangle)

FIGURE 2-2
(Continued)

Geologic Map Legend For
Pole Creek GRA
(ID-010-10)
Owyhee County, Idaho

Qal - Alluvium

Tbb - Banbury Basalt: Olivine basalt and minor interbedded stream and lake deposits.

Tbs - Banbury Basalt: Volcaniclastic sediments and local diatomite.

Tlj - Tuff of Little Jacks Creek: Extremely densely welded. Flow-layered rhyolite tuff.

Tju - Upper Flows of Juniper Mountain: Red, densely welded rhyolite tuff.

Tjl - Lower Flows of Juniper Mountain: Red, densely welded rhyolite tuff largely remobilized to viscous lava.

Tsr - Tuff of Swisher Ridge: Densely welded rhyolite tuff with minor vitrophyres and non-welded tuff.


- Fault (dashed where inferred).


- Geologic contact (dashed where inferred).

2.2.1 Geomorphology

The Pole Creek GRA encompasses 180 square miles in the Owyhee Upland sub-province of the Columbia Intermontane physiographic province. The Owyhee Upland is a relatively flat plateau that parallels the Snake River Plain and includes portions of Idaho, Oregon, and Nevada. The northern part of the Owyhee Upland includes South Mountain and the Silver City Range. These peaks have elevations in excess of 8,000 feet whereas the bulk of the surrounding basalt covered plateau stands at an elevation of about 5,500 feet.

The Pole Creek GRA contains two WSAs; WSA 16-44 and WSA 111-18, that have a combined area of 36,019 acres. The study area is about 17 miles southeast of South Mountain and seven miles South of a prominent drainage divide that extends eastward from South Mountain. Outside the GRA streams around South Mountain have a radial drainage pattern; those emanating from the divide east of South Mountain exhibit a trellis pattern. All of the streams are part of the Owyhee River system. Perennial streams that drain the GRA include Pole Creek, Carnas Creek, and Deep Creek. Un-named, intermittent, first-order streams drain parts of the study area. Unlike the South Mountain area, all of the streams within the GRA exhibit a dendritic drainage pattern. About 40 percent of the GRA is characterized by basalt capped upland; the remainder of the area is in slopes along stream valleys. The valleys are incised about 400 to 500 feet into the upland surface.

Total relief in the Pole Creek GRA is about 1,200 feet. Local relief along the major streams is as much as 600 feet. The highest point (5,780 feet) is near the western edge of the GRA. The lowest point (4,750 feet) is along Deep Creek, near the southern edge of the area.

2.2.2 Lithology and Stratigraphy

Rocks within or near the Pole Creek GRA range from Paleozoic metamorphic units to the Tertiary Banbury Basalt (Figure 2-2). This discussion relies heavily upon work by Berry and others[2] and Bennett[7].

Paleozoic metamorphic rocks and Mesozoic intrusives comprise the Pre-Tertiary basement exposed in the Owyhee Mountains portion of the Owyhee Uplands sub-province. These rocks underlie the Castle Creek and South Mountain areas and the Silver City Range. Paleozoic metamorphic rocks in the Silver City Range consist of quartz-biotite schists and quartzite. Quartz-biotite schists comprise the bulk of the Paleozoic rocks exposed in the Castle Creek area. The age of these units is not well known. Neil[9] suggests that the metaquartzites represent turbidite sequences that were derived from a stable Paleozoic shelf to the east. This is consistent with Newton's[10] depositional basin model (Figure 2-3) if the actual margin of the western Late Paleozoic is somewhat east of where it has been mapped, or if the metamorphic rocks in this area are Middle or Early Paleozoic. Pre-Cenozoic rocks in the South Mountain area compose a sequence of schists, quartzites, and marbles that are over 3,000 feet thick. These occur as roof pendants and xenoliths in Late Mesozoic and Cenozoic intrusive masses. Paleozoic intrusives in the South Mountain area include gray, locally gneissic, biotite-hornblende-quartz diorite and granodiorite[11]. Aplite and pegmatite dikes and a large mass of hornblende gabbro also are exposed. Intrusives in the Silver City Range are dominantly biotite granodiorite with lesser amounts of quartz monzonite, granite, and alaskite. This Paleozoic assemblage is not exposed in the Pole Creek GRA; however, similar rocks may occur at depth beneath the Tertiary cover. Volcanic rocks equivalent to the Challis Volcanics are the oldest Tertiary rocks in the Owyhee Upland. They consist of compound cooling units of densely welded rhyodacitic tuff up to 1,000 feet thick.

The bulk of the rocks in the Owyhee Upland resulted from bimodal rhyolite-basalt Miocene volcanism. In the Idaho and Oregon portions of the Owyhee Upland, the Miocene volcanics are divided into three major sequences: a lower basalt sequence, a middle silicic sequence, and an upper basalt sequence. The lower basalt sequence consists of latite and alkaline olivine basalt flows whose aggregate thickness is up to several thousand feet. The latite and basalt occur as thin, vesicular, interbedded flows that unconformably overlie the Pre-Tertiary basement. This lower basaltic unit is the same age as the Columbia River basalt group; however, it is much more alkaline that the Columbia River basalt group.

The middle silicic sequence, also known as the Idavada Volcanics[7], composes a large volume of ash-flow tuffs and ignimbritic units that underlie most of the Owyhee Upland. Oldest of these is the Silver City rhyolite, a compound cooling unit of remobilized, densely welded tuffs that are up to 600 feet thick. The Silver City rhyolite is followed by units from the Juniper Mountain volcanic center that include the tuff of Swisher Ridge, the Badland tuff, and interbedded tuffaceous sandstones and siltstones. Younger Miocene silicic flows in the Owyhee Upland include flow-layered and flow-banded rhyolites and tuffs of Duck Valley, Black Mountain, Browns Creek, and Little Jacks Creek.

The upper basalt sequence comprises the wide-spread flows of the Banbury Basalt. The Banbury Basalt sequence contains many thin flows of fine-grained, vesicular, alkaline-olivine basalt and minor interbedded sedimentary units. The sedimentary units contain basalt clasts, tuffaceous sands and gravels, ash beds, and local diatomite. It also includes alluvial and fanglomeratic sediments.

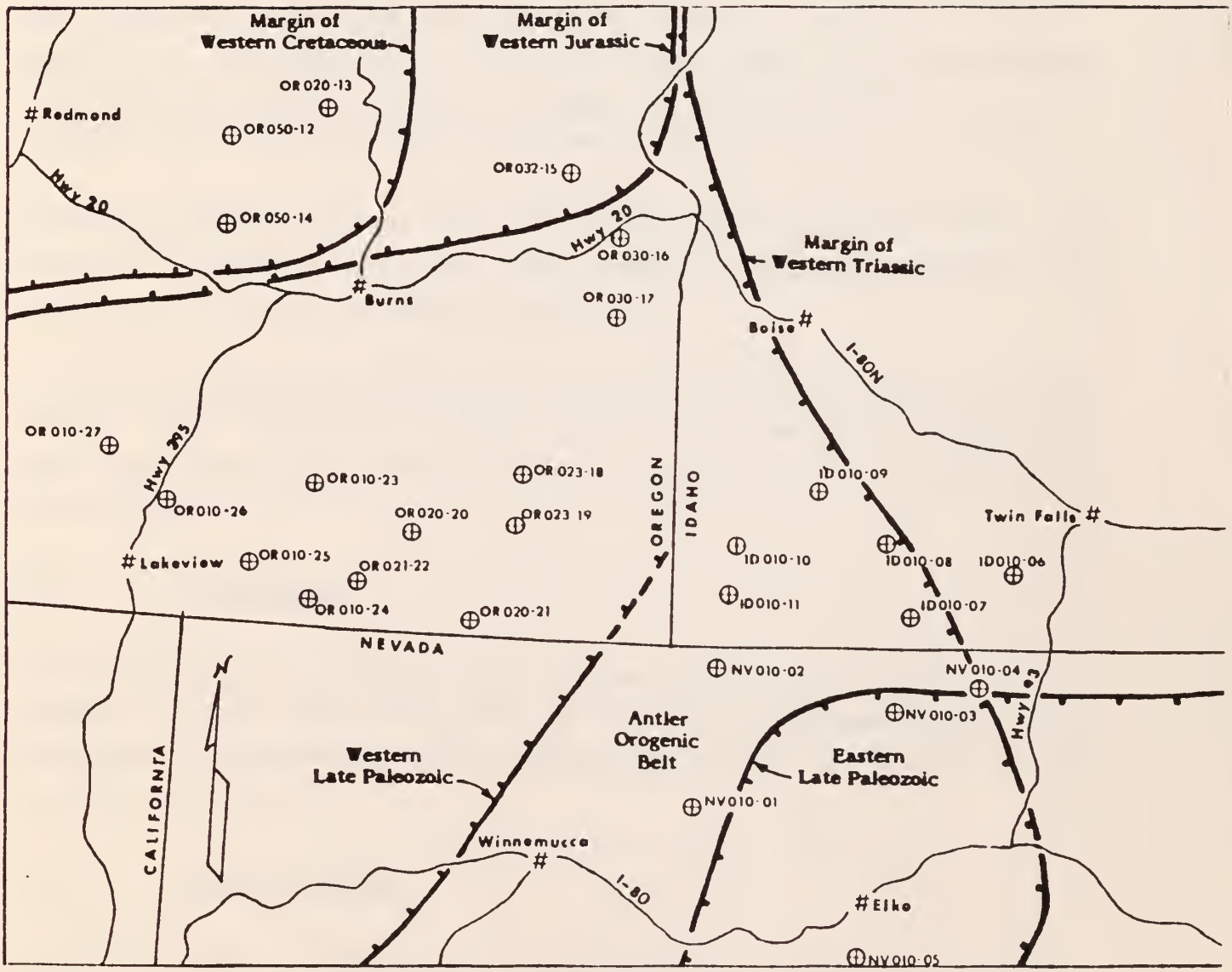
2.2.3 Structural Geology

Structural information in the Pole Creek GRA is minimal due to the amount of Tertiary cover. Lineaments of Basin and Range origin have been interpreted from LANDSAT imagery and topographic maps by Schlicker[12] specifically for this project. Bennett[7] has postulated the occurrence of a major caldera just north of the study area. The southern rim of the proposed caldera is located along a drainage divide that is about six miles north of the Pole Creek GRA. The origin of these linears and arcuates and the nature of the Pre-Tertiary basement is unknown. Cretaceous intrusive bodies and associated mineralization occur at a considerable distance to the north in Idaho, and south of the area, in Nevada. Cretaceous rocks are not exposed within the GRA.

Paleozoic metasedimentary rocks north of the GRA present an enigma. If the northeast trending Antler orogenic belt extends to the margin of the Idaho Batholith, then virtually all of the Owyhee Upland would have been above sea-level during the Late Paleozoic[10]. Therefore, the Paleozoic units of undetermined age that occur near South Mountain would have to be Early Paleozoic. Conversely, if the Antler orogenic belt takes a more easterly trend in southern Idaho, it is conceivable that these units could be part of the western Late Paleozoic assemblage.

FIGURE 2-3

Paleogeographic Map[10]
Oregon-Idaho-Nevada
Tri-State Area



The estimation of the potential for oil and gas in several GRAs in the Owyhee Upland is affected, at least in part, by this problem. The presence of Late Paleozoic petroleum host rocks would enhance the oil and gas potential of the study area. Newton[10] suggests that the area was affected by the Antler and subsequent Sonoma orogenies, and is devoid of Late Paleozoic units. By Late Devonian time, the Antler Orogeny developed along a north-northeast trending swath through northwest Elko County, Nevada, and on into southwestern Idaho. The Pole Creek GRA may lie near the axis of the Antler orogenic belt. As a direct result of the Antler orogenic uplift, a Pennsylvanian clastic wedge developed along the margins of the uplift. The orogeny culminated in a period of extensive thrust faulting that includes the Roberts' Mountain thrust south of the GRA.

The Sonoma Orogeny occurred during the Permian in north-central Nevada[10]. This deformational episode included more thrust faulting, which further complicates the interpretation of the structural geology of this area.

A tremendous increase in volcanic activity occurred in the tri-state area during the Late Cenozoic. This is recorded by the large volume of Tertiary extrusives that blanket the area. The influence of Late Cenozoic Basin and Range block-faulting is not will known in the Pole Creek GRA.

2.2.4 Paleontology

The paleontology of the Pole Creek GRA is not well known because the area is covered primarily by welded rhyolite tuffs or other non-fossiliferrous lithologies. Miocene fossil assemblages, including mammals, fish, mollusks, and plants may occur within restricted lacustrine environments[13].

2.2.5 Historical Geology

Pre-Tertiary basement rocks that occur near the Pole Creek GRA consist of Paleozoic metamorphic rocks and Mesozoic intrusives. They are exposed in the Silver City Range, at South Mountain and in the Castle Creek areas of the Owyhee Uplands. Paleozoic structural evolution of the Owyhee Upland is not well known. There are no contiguous exposures of definitive Paleozoic lithologies due to the overlying Tertiary deposits. Therefore, the position of the Owyhee Upland relative to the Paleozoic Antler orogenic belt is not fully understood. A few exposures of Paleozoic turbidite sequences suggest

that the Owyhee Upland area was part of the Late Paleozoic eugeoclinal depositional basin (Figure 2-3). Mesozoic intrusive activity has affected parts of the province. This intrusive activity is associated with minor metallic mineralization north of the GRA. Intrusives in the South Mountain area have radiometric ages between 87 million years[14] and 45.2 million years[11].

The oldest Tertiary rocks in the province are equivalents of the Eocene Challis Volcanics. They form an extensive sequence in the vicinity of Poison and Castle Creeks. The Challis Volcanics have been dated at 43.6 million years[9].

During Miocene time the Owyhee Upland sub-province was subjected to Basin and Range-type extensional faulting that was accompanied by bimodal rhyolite-basalt volcanism. The Miocene bimodal volcanic rocks form the bulk of the rocks in the Owyhee Upland. In Idaho, they are divided into three subunits; an older basaltic sequence, a middle unit composed of silicic flows and tuffs, and a younger basaltic sequence that is equivalent to the rocks in the adjacent Snake River Plain[2].

2.3 ENVIRONMENTS FAVORABLE FOR GEM RESOURCES

The Pole Creek GRA contains one environment that is highly favorable for potential diatomite resources[12]. Diatomite beds are present in this GRA in Township 11S, 2W (Figure 2-1). The environment favorable for the formation of diatomite deposits occurs within the Banbury Basalt (Figure 2-2, Map Unit Tbs). Periods of volcanic quiescence during the Tertiary permitted lakes to form on the surface of the relatively flat-lying Banbury Basalt. These lakes provided the environment necessary for diatoms to flourish and form taphogenic accumulations of their siliceous tests. The size of the potential deposits is primarily dependent on two factors; the duration of the period of quiescence, and the lateral extent of the favorable lacustrine environment. Whereas diatomite deposits occur as interbeds at differing stratigraphic intervals within the basalts, it is impossible to predict the spatial distribution of potential deposits except where they are exposed. The probability of the occurrence of unknown diatomite deposits anywhere within the Tbs map unit is excellent. The depositional model does not, however, allow the prediction of the precise location of such deposits.

The Pole Creek GRA has a low favorability for the occurrence of environments favorable for coal[15], clinoptilolite and bentonite[12]. The area contains no environments that exhibit favorable characteristics for other GEM resources.

2.3.1 Environments for Metals Resources

The entire Pole Creek GRA is underlain by un-mineralized volcanic and volcaniclastic rocks[16]. Occurrences of metallic mineralization are not known in the area. Geochemical data from stream sediment samples in the northern three-fourths of the GRA do not indicate the presence of anomalous values for any elements that might be associated with mineralization[7]. The potential for mineralization in this area is rated very low by Bennett (personal communication, 1982). Recognition criteria for environments favorable for the accumulation of metallic resources are not present. However, sub-surface data are notably lacking.

2.3.2 Environments for Oil and Gas Resources

The Pole Creek GRA is unfavorable for the occurrence of oil and gas resources. Only a small portion of the southern part of the GRA currently is leased or is under application for oil and gas leases. The area is within the boundaries of Miocene Humboldt and Bruneau Lakes. There is no direct evidence, however, that the GRA is favorable for potential oil and gas resources[10]. Favorable Late Paleozoic and Mesozoic environments probably do not exist in the area.

2.3.3 Environments for Oil Shale and Tar Sands Resources

The Pole Creek GRA contains no environments favorable for the occurrence of oil shale or oil impregnated sands[17]. The area is underlain predominantly by Tertiary volcanics of felsic to ferromagnesian composition. Potential host rocks are largely tuffaceous and contain only minor amounts of non-volcanic clastic material. Favorable lithologies are not present.

2.3.4 Environments for Geothermal Resources

The Pole Creek GRA contains no environments favorable for geothermal resources. There exist none of the criteria that would indicate the presence of a favorable environment[18]. There are no known major Basin and Range faults; there is no evidence of current or recent hydrothermal activity; there are no known geothermal occurrences associated with Tertiary volcanism.

2.3.5 Environments for Uranium and Thorium Resources

The Pole Creek GRA does not contain any environments that are favorable for the occurrence of uranium or thorium deposits[19]. The GRA does not exhibit any of the lithologic, alteration, or geochemical criteria that would suggest the presence of uranium or thorium. Volcanogenic environments, such as McDermitt caldera and Virgin Valley, are not present in the study area.

2.3.6 Environments for Coal Resources

The Pole Creek GRA contains environments that have a low favorability for the occurrence of coal and lignite deposits[15]. The chances for coal to have formed in the study area are remote. The geology of the GRA does not support the conclusion that euxinic environments favorable for the formation of coal deposits existed in the area. Much of the area either is mantled with accumulations of lavas and related volcanic products or has been modified by adjacent volcanic activity. There is a chance that Miocene lacustrine strata could contain limited amounts of thin, low-grade lignites.

2.3.7 Environments for Industrial Minerals Resources

Volcanic rocks in the Pole Creek GRA may contain environments favorable for the development of bentonite and clinoptilolite as alteration products of felsic flows and tuffs. There is no direct evidence, however, that the felsic volcanics in this area have been altered in this manner[12].

As discussed in Section 2.3, above, diatomite occurs near WSA 111-18. Both of the WSAs in this GRA are underlain, at least in part, by potential diatomite-bearing rocks of geologic map unit Tbs.

2.3.8 Environments for Paleontological Resources

Environments that are potentially favorable for the occurrence of fossiliferous strata are limited because the majority of the Pole Creek GRA is characterized by welded rhyolite tuffs or other non-fossiliferous lithologies. No fossil localities or other direct or inferred evidence that indicates favorability exist in the study area(13).

2.3.9 Environments for Geologic Hazards

Potential geologic hazards in the Pole Creek GRA consist of faults, landslides, and volcanic centers(12). These features were noted from aerial photographs, geologic maps, and topographic maps. There is no historical record of violent seismic or volcanic activity in the area. The potential for mass movement exists along all the over-steepened slopes within the GRA.

2.3.10 Educational and Scientific Localities

There are no known ESLs in the Pole Creek GRA.

3. ENERGY AND MINERAL RESOURCES IN THE POLE CREEK GRA

The entire Pole Creek GRA is highly favorable for the occurrence of diatomic deposits. Conversely, it is unfavorable for most other GEM resources.

3.1 KNOWN DEPOSITS

This area contains no known deposits of GEM resources, nor is it located in or near any known mineral belt or mining district.

3.2 OCCURRENCES

The Pole Creek GRA contains one occurrence of diatomite in Township 11S and Range 2W[12] (Figure 2-1). This occurrence is not noted in the CRIB or MILS databases. There are no CRIB localities, no NURE-related uranium occurrences and only one MILS locality in this GRA. The MILS locality is near the southeast edge of the GRA; it is not within the boundaries of either of the two WSAs in this area (Figure 3-1). The explanation for this single MILS locality is unclear as to the specific commodities and amounts produced[20]. The MILS listing indicates that a small amount of mercury may have been produced at this site.

3.3 CLAIMS

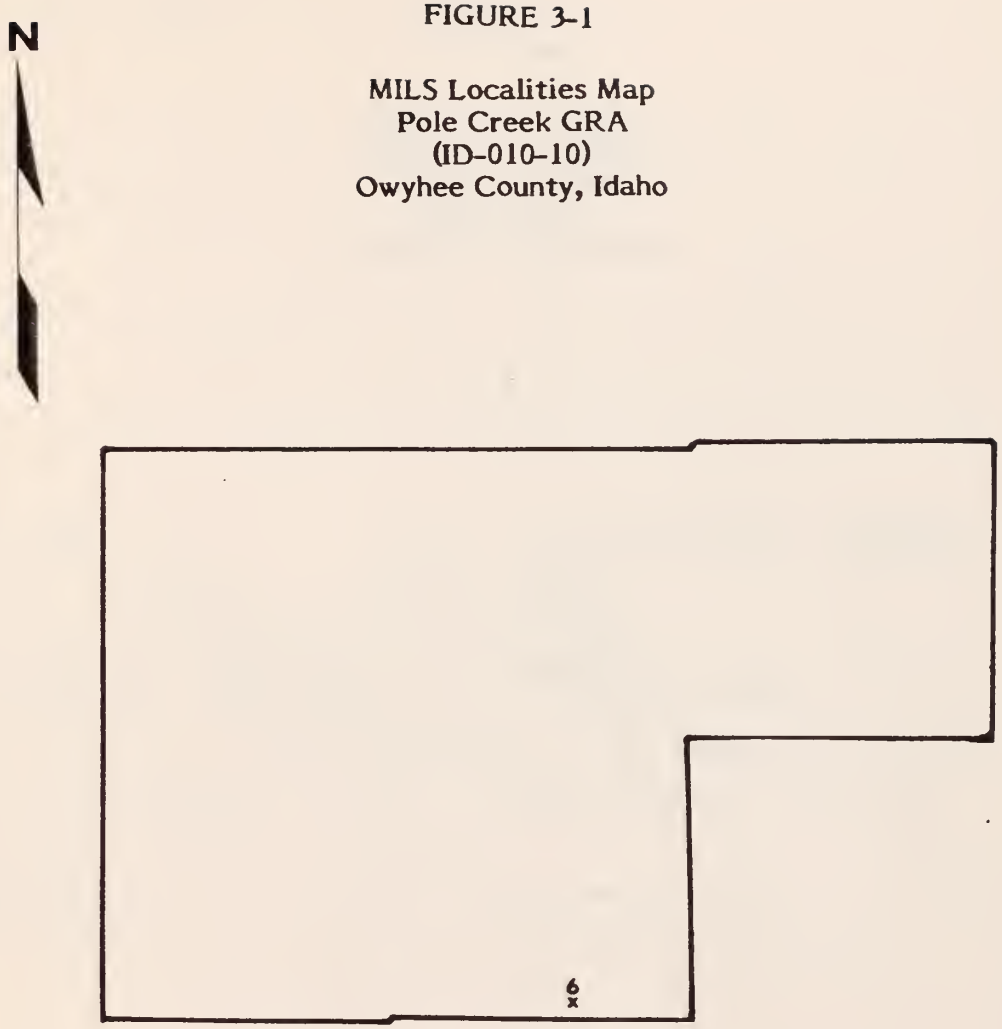
There are no recorded claims in the Pole Creek GRA. Claims data used in this evaluation are current as of 15 August, 1982.

3.4 LEASES

The southernmost part of Township 11S, 2W is leased or subject to lease application for oil and gas. The area that is involved in the leasing activity is in neither of the WSAs. This leasing activity is adjacent to more extensive leasing south of the Pole Creek GRA.

FIGURE 3-1

MILS Localities Map
Pole Creek GRA
(ID-010-10)
Owyhee County, Idaho



Scale 1:250,000
(Jordan Valley $1^{o}x2^{o}$ NTMS Quadrangle)

This map is an overlay for Figures 2-1 and 2-2.

FIGURE 3-1
(Continued)

Explanation Of The
MILS Localities Map
Pole Creek GRA
(ID-010-10)
Owyhee County, Idaho

```
  6
6 NAME- HUMBUG                                  REFERENCE NUMBER- 0160730071
  STATE- IDAHO                    COUNTY- OWYHEE                ELEV:PREC- 1615M:500M
  LATITUDE-   N 42 25 17        PRECISION-  500M
  LONGITUDE- W 116 23 33  REFERENCE POINT- ORE BODY
  UTM:  ZONE 11N  NORTHING 4699434  EASTING 536267
  PUBLIC LAND SURVEY  TOWNSHIP- 011 S   RANGE- 002 W
      DESCRIPTION     SECTION- 34  SECTION SUBDIVISION-
  RIVER BASIN- 70E   JORDAN CREEK                DOMAIN- UNKNOWN
  STATUS- UNKNOWN          OPERATION TYPE- UNDERGROUND
  MESA ID NO.            YEAR FIELD CHECKED-       MAP REPOSITORY-  FOC
  MAP NAME- JORDAN VALLEY       TYPE- 1:250K
  1:250,000 MAP NAME- JORDAN VALLEY       MINERAL PROPERTY FILE- 42.300
  PRIMARY NAME- HUMBUG
  OTHER NAMES-  OWYHEE MERCURY PROPERTY
  COMMOD MOD-
  POWERS HA 1917 IDA BUR MINES & GEOL. MIN RES RPT NO 4, P18
  PROD: <$300,000
  ALSO REPORTED TO OCCUR IN SEC 35 & 36, T11S R2W & SEC 2 & 3,
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3.5 DEPOSIT TYPES

There are no known deposits with the Pole Creek GRA. Should the diatomite occurrences prove to be viable deposits they would probably have geometries similar to known stratiform deposits.

3.6 MINERAL ECONOMICS

The Pole Creek GRA is classified as being highly favorable (4D) for the occurrence of potential diatomite resources.

3.6.1 Diatomite

Diatomite is used primarily as a filter-aid, as an industrial filler, and other miscellaneous applications, including insulation[21]. Diatomite was produced by seven companies in four states in 1981[22]. California accounted for more than 50 percent of total diatomite production. The United States is the largest world producer and consumer of diatomite. The United States, however, is a net exporter of this commodity. Demand for diatomite is expected to increase at an annual rate of three percent through 1990. World resources of diatomite are adequate for the foreseeable future, but the need for near-market sources will encourage development of new sources.

3.7 STRATEGIC AND CRITICAL MINERALS AND METALS

The Pole Creek GRA is not favorable for any of the strategic and critical minerals listed in Table 3-4 of the TERRADATA report entitled "Procedures for the Assessment of Geology, Energy, and Minerals (GEM) Resources."

4. CLASSIFICATION OF LAND FOR GEM RESOURCES POTENTIAL

The precise location of specific favorable environments within a given GRA depends upon three principal factors:

- The precision and specificity of available data;
- The nature (size and spatial distribution) of anticipated deposits as predicted from known models; and
- The geometry of the favorable geologic environments.

Commodity-specific information in the Pole Creek GRA is limited. Sub-surface information is virtually non-existent. Therefore, the entire area, rather than specific subareas, has been classified for individual GEM resources. (see Figure 4-1 and Table 4-1).

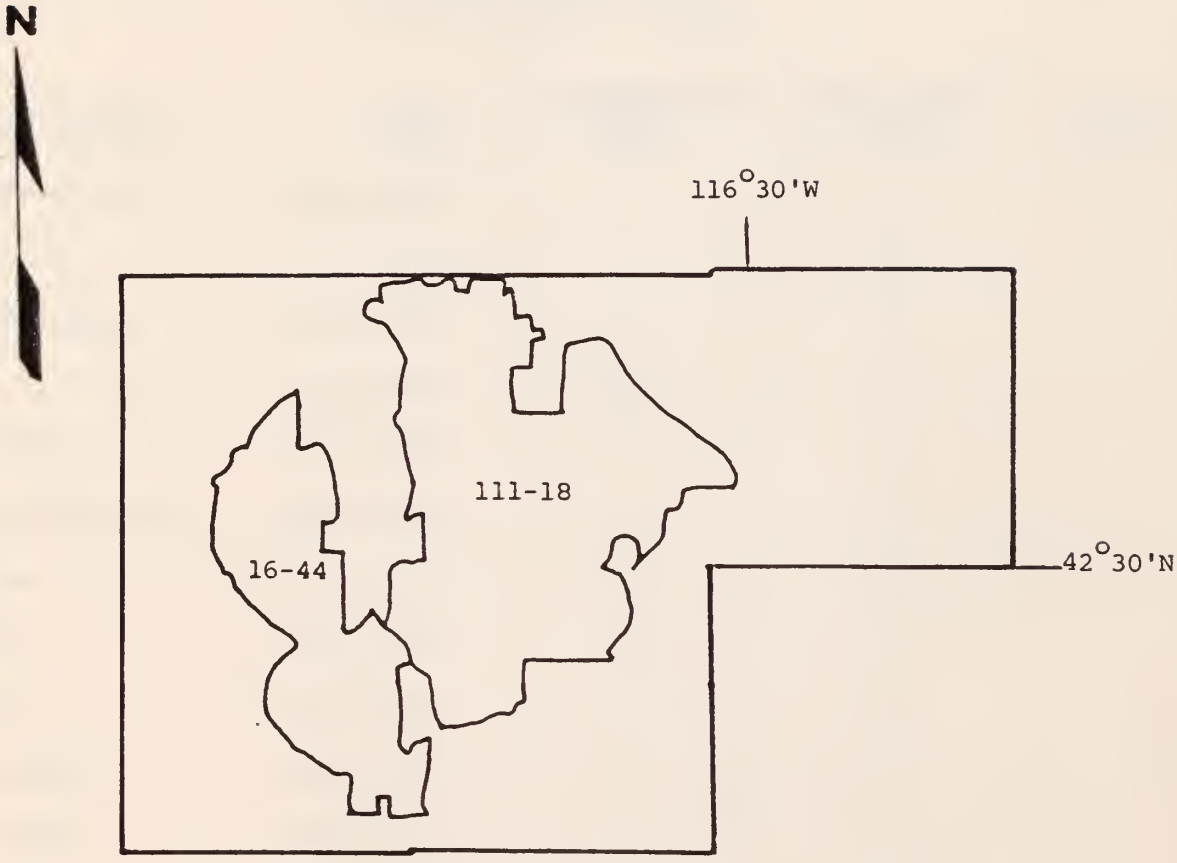
The Pole Creek GRA is highly favorable (Class 4) for potential diatomite resources because it contains the appropriate geologic environment and one known occurrence of the resource[12]. Diatomite occurs within the GRA near WSA 111-18. Similar lacustrine environments may occur as interbeds within the within the Banbury Basalt throughout the GRA. The confidence level (D) is assigned to this classification because the available data provide direct, irrefutable evidence for the occurrence of this commodity within the study area.

The Pole Creek GRA is least favorable (Class 1) for the occurrence of metallic deposits[16]. The area does not exhibit any geologic characteristics to warrant a higher classification. It is primarily underlain by young, un-mineralized volcanogenic rocks. There is no evidence that a mineralizing process has been active in the area; there are no associated metallic mineral deposits, occurrences, trends, or geologic anomalies. The confidence level (B) of this evaluation signifies that the available geologic data, in this case negative data, provide indirect evidence to refute the possible existence of metallic resources.

The study area has a low favorability (Class 2) for coal resources[15]. Environments favorable for the accumulation of coal deposits do not exist in the area. The geologic history of the study area does not support environments favorable for the formation of coal deposits because much of the area is mantled with and/or modified by Tertiary volcanism. Low-grade lignite occurs in Oregon, northwest of the study area, and a minor amount of coal has been mined for domestic consumption in parts of southwest Idaho. Lacustrine units within the volcanic strata may contain thin lignite beds; therefore, a low (B) confidence level is assigned.

FIGURE 4-1

Land Classification Map
Pole Creek GRA
(ID-010-10)
Owyhee County, Idaho



Scale 1:250,000
(Jordan Valley 1°x2° NTMS Quadrangle)

This map is an overlay for Figures 2-1 and 2-2.

Entire GRA classified, no subareas.

TABLE 4-1

Classification Of Lands Within The
Pole Creek GRA
(ID - 010 - 10)
Owyhee County, Idaho
For GEM Resource Potential

COMMODITY	AREA	CLASSIFICATION LEVEL	CONFIDENCE LEVEL	REMARKS
Metals/Non-Metals	Entire GRA	1	B	
Geothermal	Entire GRA	1	B	
Uranium/Thorium	Entire GRA	1	A	
Coal	Entire GRA	2	B	
Oil and Gas	Entire GRA	1	B	
Tar Sands/Oil Shale	Entire GRA	1	C	
Limestone	Entire GRA	1	A	
Bentonite	Entire GRA	2	A	
Diatomite	Entire GRA	4	D	
Clinoptilolite	Entire GRA	2	A	
Paleontology	Entire GRA	1	A	
Hazards	See Hazards Map (GRA File)			
ESLs	None	1	C	

LEGEND:
Class 1 - Least Favorable
Class 2 - Low Favorability
Class 3 - Moderate Favorability
Class 4 - High Favorability

Confidence Level A - Insufficient data or no direct evidence
Confidence Level B - Indirect evidence available
Confidence Level C - Direct evidence but quantitatively minimal
Confidence Level D - Abundant direct and indirect evidence

Clinoptilolite and bentonite are common alteration products in volcanic terraines. The entire GRA is assigned a low favorability (Class 2) for these commodities because the requisite favorable geologic environment is inferred but not known to be present[12]. There are no known occurrences or other direct or indirect data to substantiate this classification. Therefore, the lowest confidence level (A) is assigned.

The Pole Creek GRA is classified least favorable (Class 1) for geothermal[18], uranium and thorium[19], tar sands and oil shale[17], limestones[12], and paleontological[13] resources because the geologic environments and inferred geologic processes do not indicate favorability for the presence or accumulation of these commodities. With the exception of oil shale and tar sands, all of the least favorable classifications have low confidence levels (A or B) because there is little or no evidence to support or refute the assessments (Table 4-1). The amount of volcanism in this area in the past enhances the confidence level of the oil shale and tar sands evaluation (C).

TERRADATA's classification of the Pole Creek GRA for leasable commodities is in agreement with the USGS classificiation of leasable commodities in the same area[23, 24, 25].

5. RECOMMENDATIONS FOR FUTURE WORK

Further surface geologic investigations, including detailed mapping and stratigraphic studies, could enhance the confidence levels of many of the classifications in the Pole Creek GRA. It is doubtful, however, that the original classifications would change substantially. Sub-surface investigations are probably not warranted in this area due to the costly nature of the available methods. Geophysical and geochemical surveys might provide some insight into the potential resources in the study area. Detailed examination of the inferred caldera by geophysical methods might be important as similar structures are known to be mineraled in other areas.

- APPENDIX A -

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